

CLAIMS

1. A memory cell for a magnetic memory device comprising:
a first hard magnetic layer having a first fixed magnetization vector,;
a second hard magnetic layer having a second fixed magnetization vector,
a first soft magnetic layer having a first alterable magnetization vector and disposed adjacent to the first hard magnetic layer, and
a second soft magnetic layer having a second alterable magnetization vector and disposed adjacent to the second hard magnetic layer;
wherein the first and the second soft magnetic layers are magnetostatically coupled antiparallel to each other to form a flux-closed structure.
2. The memory cell as recited in claim 1, wherein the first and the second soft magnetic layers are disposed between the first and the second hard magnetic layers.
3. The memory cell as recited in claim 1, wherein the first and the second hard magnetic layers are disposed between the first and the second soft magnetic layers.
4. The memory cell as recited in claim 1, further comprising an anti-ferromagnetic layer disposed adjacent to one of the first and the second hard magnetic layers to fix the orientation of the magnetization vector therein.
5. The memory cell as recited in claim 4, further comprising an assistant magnetic layer disposed adjacent to one of the first and the second hard magnetic layers, wherein the assistant magnetic layer having a magnetization vector anti-parallelly aligned with one of the first and the second hard magnetic layers to reduce the static magnetic field thereof.

6. The memory cell as recited in claim 1, further comprising an electrically conductive layer disposed between the first and the second soft magnetic layers for passing an electric current therethrough.
7. The memory cell as recited in claim 6, wherein the memory cell is adapted to allow passing of an electric current in a first direction and at least one of the magnetization vectors of the first and the second hard magnet layers is orientated along a second direction oblique to the first direction.
8. A magnetic memory device comprising a plurality of memory cells as claimed in claim 1
9. The magnetic memory device as recited in claim 8, further comprising an electrically conductive line coupled to the plurality of memory cells.
10. The magnetic memory device as recited in claim 9, further comprising a plurality of gate members each coupled to the plurality of memory cells through the electrically conductive line for controllably supplying an electric current to the respective memory cell through the electrically conductive line.
11. The magnetic memory device as recited in claim 9, wherein the electrically conductive line is provided for performing both a writing operation and a reading operation.
12. A memory cell for a magnetic memory device comprising:
 - a first hard magnetic layer having a first fixed magnetization vector,
 - a second hard magnetic layer having a second magnetization vector;
 - a first soft magnetic layer disposed adjacent to the first hard magnetic layer, the first soft magnetic layer having a first alterable magnetization vector; and

a second soft magnetic layer disposed adjacent to the second hard magnetic layer, the second soft magnetic layer having a second alterable magnetization vector,

wherein the memory cell is adapted to allow passing of an electric current in a first direction and at least one of the first fixed magnetization vector and the second fixed magnetization vector is oriented oblique with respect to the first direction of the electric current.

13. The memory cell as recited in claim 12, further comprising an electrically conductive layer disposed between the first and the second soft magnetic layers for allowing the electric current to pass through.
14. The memory cell as recited in claim 13, wherein the first and the second soft magnetic layers are magnetostatically coupled antiparallel to each other to form a flux-closed structure.
15. A magnetic memory device comprising a plurality of memory cells as recited in claim 12.
16. The magnetic memory device as recited in claim 15, further comprising an electrically conductive line coupled to the plurality of memory cells for passing an electric current therethrough.
17. The magnetic memory device as recited in claim 16, further comprising a plurality of gate members each coupled to the plurality of memory cells through the electrically conductive line for controllably passing an electric current to the respective memory cell through the electrically conductive line.

18. The magnetic memory device as recited in claim 15, wherein the electrically conductive line is provided for performing both a writing operation and a reading operation.